

Human Organization, Vol. 56, No. 4, 1997
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0018-7259/97/040418-9\$1.40/1

Folk Management among Belizean Lobster Fishermen: Success and Resilience or Decline and Depletion?

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Fishermen from Caye Caulker, Belize use a local management system based on traditional "areas," or territories, which limits access to the fishing areas around the cay. Data from Northern Fishermen Cooperative Society annual reports suggest that fishermen members of the cooperative have produced lobster tails at a stable rate for over thirty years. Other data from observations and interviews suggest that this seemingly effective local management system may be beginning to teeter. Many factors are shifting the nature of tenure and access to fishing areas in the lobster fishery around Caye Caulker. Other factors are increasing pressure on the lobster population. Here I will discuss changing tenure patterns, fishermen's children's emigration from the cay, and tourism development at the cay. Though these factors are defining characteristics of success among villagers at Caye Caulker, they are in other ways threatening the resilience of this folk management system.

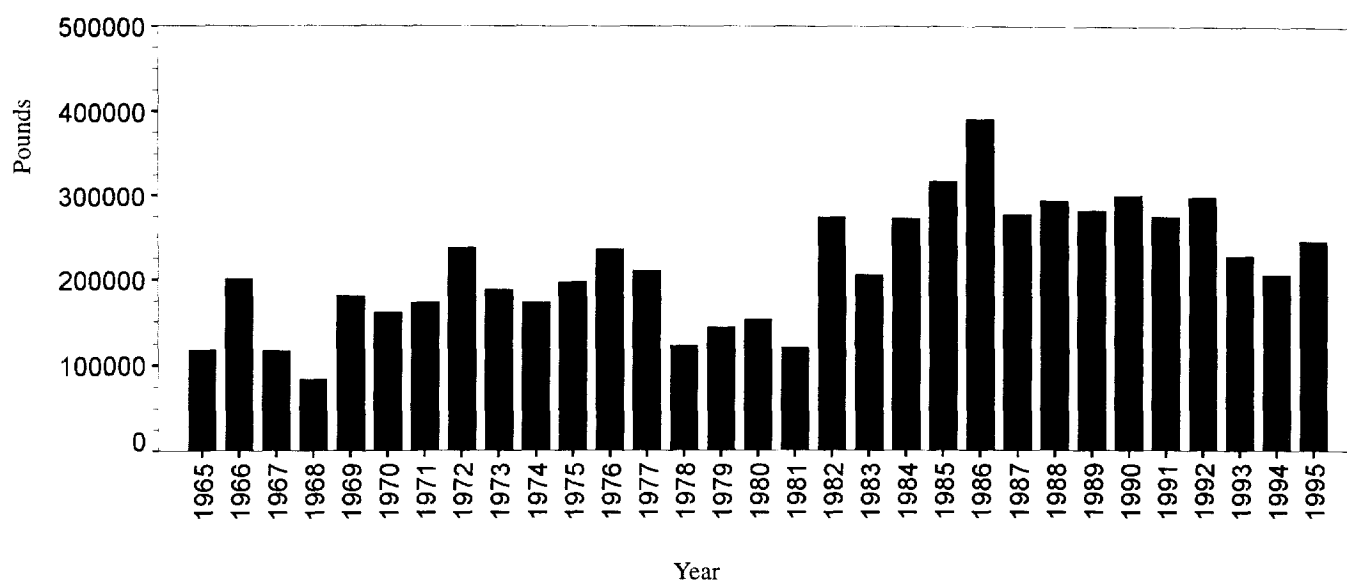
Key words: fisheries management, folk management, local management, fishing cooperatives, tourism; Belize

Caye Caulker is a small cay off the Belizean coast about twenty miles northeast of Belize City. The cay is five miles long and about 3/4 mile at its widest point. Caye Caulker village occupies a narrow strip of the cay one mile long by about three blocks wide. The remainder of the cay is marshy littoral forest and mangroves. The original population of the cay were refugees of the War of the Castes, who migrated to the area from the Yucatan after 1848 (Craig 1966:62). Islanders who have grown up on the cay, and have family roots there, primarily identify themselves as "Spanish." Spanish, English, and an English-based Creole are all commonly spoken, while most islanders are bi- or multi-lingual in these languages. A 1980 census reported a population of 413 at Caye Caulker (Sutherland 1986:15). Since 1980 the population has at least

doubled, and continues to grow and become more diversified. In addition to an increasing number of foreigners moving to the cay, other new residents are Belizeans of different ethnic groups than the original "Spanish" inhabitants.¹ This small village is rapidly changing, primarily due to fishermen's economic success and the increase of tourism on the cay.

Lobster fishermen from Caye Caulker organized a fishing cooperative in 1960, the Northern Fishermen Cooperative Society, Ltd. (NFCS). Fishermen from other parts of Belize have followed their lead and have organized other fishing cooperatives since this time. Technology, gear, and the local environment to which these are adapted distinguish Caye Caulker lobster fishermen from lobster fishermen in other parts of the country.² Caye Caulker fishermen predominantly use traps, while a large number of lobster fishermen in other parts of the country dive for lobsters. In addition to the use of traps, and perhaps an extension of it, Caye Caulker fishermen practice a folk management system (FMS). The FMS practiced among Caye Caulker lobster fishermen includes the fishermen's practice of territoriality, their community membership at Caye Caulker, and their organization of and membership in a producers' cooperative. This system has, at least until the recent past, contributed to stable production of lobster tails by the NFCS. Cooperative organization and restriction of access to local fishing areas through territoriality have provided increased incomes and access to other forms of capital for Caye Caulker fishermen and their families. The cooperative's growth, diversification, and increasing processing capacities coupled with tourism development at and emigration of many fishermen's children away from Caye Caulker threaten the success and resilience of the folk management system.

Thomas King is a Ph.D. candidate in Anthropology at Pennsylvania State University. The research on which this paper is based was supported in part by the Department of Anthropology at the University of Iowa. Special thanks to the fishermen, administrators, and staff of the Northern Fishermen Cooperative Society; Orlando August of the Central Bank of Belize; and other folks at Caye Caulker and in Belize City who were willing to discuss their problems and concerns around which this research emerged; to three anonymous reviewers who provided critical and insightful comments and suggestions; and to M.A. committee members E. Paul Durrenberger, Michael Chibnik, Douglas Midgett, and Scott Schnell, who all provided insightful comments on previous drafts of this paper. The author alone is responsible for all the material presented.



Mean = 216657, S.D. = 71933, Coef. Var. = 33%

Source: NFCS Annual Reports 1980-1995

Figure 1. Lobster Tail Production 1965-1995 NFCS

Folk Management and Success at Caye Caulker

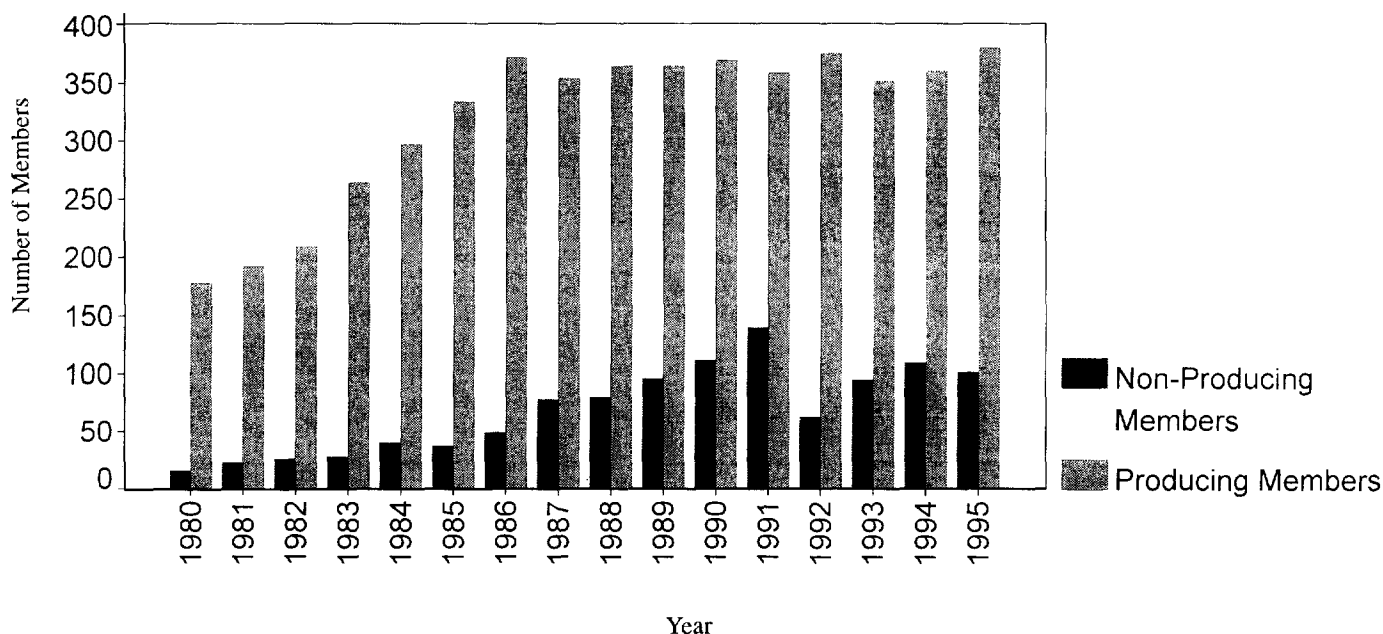
The fishermen-members of the NFCS have produced stable levels of lobsters for at least 30 years (see Figure 1). The interrelated institutions of Caye Caulker fishermen's territoriality, community membership, and the organization of and membership in the NFCS have contributed to this stable catch. Territoriality, partially determined through community membership at Caye Caulker, manages access to and distribution of lobster fishing areas among Caye Caulker fishermen and has limited entry to the local lobster fishery. Community membership, becoming more complicated with the influx of people on the caye, also plays a role in allocating access to local lobster resources in other less legitimate ways, such as tolerance of theft. Cooperative organization has allowed higher degrees of economic self determination through the autonomous harvest, processing, and export of seafood products, of which lobster is the most significant (Palacio 1996:31-38). Due to these factors I argue that these institutions constitute a folk management system (FMS).

COOPERATIVE ORGANIZATION

Caye Caulker fishermen were introduced to the cooperative movement in the early 1950s by the teachings of a Jesuit priest, Father Marion Ganey. Throughout the 1950s fishermen tried to organize a fishing cooperative at Caye Caulker with Father Ganey's help. These attempts failed, due to the lack of interest

among many of the local fishermen and the colonial government's repeated denial of formal registration. In July of 1960, however, some Caye Caulker fishermen informally organized into a producing unit and received formal recognition in September of that year, when they were registered as the Northern Fishermen Cooperative Society. In 1962 the NFCS finished building a processing plant in Belize City, and were then able to produce, process, package, and export lobster products autonomously.³

At the time of this research (June and July 1995) Caye Caulker fishermen made up about half of the NFCS membership (Usher 1995). Fishermen from other parts of Belize have joined the NFCS, and have only more recently constituted a proportion of the membership large enough to match the number of Caye Caulker members. For Caye Caulker fishermen cooperative organization has meant higher incomes, access to capital and other resources, and a source of community solidarity and identity. Fishermen first realized higher incomes when the price they received for lobster tails jumped from BZE\$0.16/pound in 1960, the highest price offered by an export company before the organization of the cooperative, to over BZE\$2.00/pound, the price paid by the NFCS in 1962 (A. Vega 1995; S. Vega 1979). In recent years fishermen have received between US\$12.00 and US\$15.00 per pound of lobster tails delivered to the NFCS (NFCS Annual Reports 1980-1995). In addition to higher returns for their labor, fishermen are able to purchase inputs (such as fuel, ice, and trap materials) at less expensive prices, and access loans through the cooperative. This higher



Source: NFCS Annual Reports 1980-1995

Figure 2. NFCS Membership 1980-1995

degree of economic self determination exemplified by and derived from cooperative organization has been described by Sutherland (1986) as a major factor in fishermen's economic success.

Lobster Fishing

TRAPS AND TERRITORIES

Lobster fishermen in Belize either dive or use traps. At Caye Caulker, traps are the predominant method of capture. Caye Caulker fishermen use wooden trapezoid-shaped traps, or pots, about four feet long by one and a half feet wide at the base, which they set in the clear, shallow water (two to six meters) around the caye.⁴ This trap design was introduced to Belizean fishermen in the 1930s by a Canadian expatriate interested in exporting seafood products (Craig 1966:91-93). Fishermen have only slightly modified the original design. The spiny lobster (*Panulirus argus*) easily gnawed its way through the original net funnel entrance, unlike its North American counterpart (*Homarus americanus*), for which the trap was designed. Fishermen replaced the net with wooden slats forming a ramp-like funnel for an entrance (Craig 1966:92). Spiny lobster are nocturnal hunters and seek shelter from the sun in the daytime, therefore the traps are not baited as they are in North America. Traps are "pulled," or "hauled," with a long pole with a metal hook at the end. The clarity of the shallow water makes it easy

to spot traps. This job, however, becomes more difficult when the water is murky, usually the result of storms, and more recently due to dredging on the leeward side of Caye Chapel, a smaller privately owned caye about two hundred meters south of Caye Caulker.

The process of establishing a territory has traditionally begun when a young fisherman places a few traps at the edge of a relative's territory, usually someone with whom he has worked. Beginning with these few traps the young fisherman carves out an area for himself and establishes a territory of his own, adding more traps when he can (Sutherland 1986:23-24). Alternatively, a younger fisherman may inherit a territory, and traps to place in it, from their father or an uncle.

Fishermen traditionally place their traps in the water each year about two weeks prior to the opening of the lobster season, presently set at June 15th. Fishermen often have more than one territory; which are not necessarily adjacent to, or even near, one another. One fisherman, for instance, fishes traps in three territories; one to the south of Caye Chapel, and two others to the north and northwest of Caye Caulker, respectively. Other fishermen have their territories concentrated in one place; such as fishermen who have traps only in the front (the seaward side of the caye) or only in the back (the leeward side of the caye). Each territory has anywhere from 40 to 100 or more traps in it. A few family operations, a father and two sons for example, fish numerous territories and have as many as 1500-2000 traps. Operations of this size are infrequent and are a more recent development, to which I will return later.

Fishermen from Caye Caulker have also expanded to other areas, mostly to the south of Caye Caulker. These fishermen will sometimes live in camps on otherwise uninhabited cayes while hauling traps during the more productive parts of the lobster season. There are areas of unclaimed water available to set and haul traps, but these areas are, for most fishermen, too far away from the cayes to be worth their effort, or are otherwise only marginally productive. Younger men at the cayes who do not have territories indicated that they were not hauling traps because either "it isn't worth it" to travel the longer distances where territories have not been established, or they were choosing other income generating opportunities, either in tourism or a planned migration to the United States.

The most desirable and productive fishing areas around Caye Caulker have been claimed and further entry into the fishery is limited. This is illustrated in Figure 2, which shows the membership of NFCS divided into producing and non-producing members; the former includes members who delivered fish or lobster to the cooperative during the given season, while the latter refers to members who have delivered in the past and are members, but did not deliver in the given year. The leveling of producing members occurring around 1985-86 indicates that the fishing areas around Caye Caulker have been "filled-up." In the early 1980s Sutherland observed the beginnings of this saturation, stating that "all the workable locations close to Caye Caulker" had been claimed (1986:24).

DIVING FOR LOBSTERS

Caye Caulker fishermen who dive for lobster are typically younger men who do not have traps and access to territories. The only gear needed are fins, a mask, a gaff (a short one-meter-long wood or fiberglass pole with a hook at the end), and transportation to the reef or other suitable area for diving. Divers from Caye Caulker fish at the reef, under other natural shelters within the reef, and under artificial shelters placed within the reef; the latter practice is similar to the practice of lobster fishermen at Ascension Bay in Mexico (Leslie 1995). Divers who use artificial shelters find it impossible to avoid placing their shelters in the territories of fishermen who use traps. This is not illegal, but divers are well aware that if a fisherman finds a shelter in his territory he will likely turn it over. Those using artificial shelters are frequently accused of stealing from fishermen's traps. In addition to accusation of theft directed at them, divers are commonly blamed for destroying the reef, and in turn the whole ecosystem upon which every islander's livelihood depends. In order for divers at the reef to get at the lobsters hidden under coral and rocks, they must often steady themselves in the current by grabbing the coral, thus killing it. The older, established, and experienced fishermen (almost exclusively trap fishermen) blame these "younger guys" for many of the problems lobster fishermen face.

Territoriality and Community

CAYE CAULKER AND MAINE

Territoriality among Caye Caulker fishermen resembles territoriality practiced among Maine lobstermen. Acheson

describes two types of territories — perimeter-defended and nucleated, and the defensive behaviors associated with each (Acheson 1987:40-45, 1988:79-83 and 153-159). Nucleated territories are large, harbor based areas which have relatively fluid and less strict boundaries than those enforced in the perimeter-defended areas. Fishermen from the same harbor place their traps within the nucleated territory and reserve the rights to this area for fishermen only from their home harbor. In this respect nucleated territories are community based (Acheson 1988:48-52), where the significant defense is against intrusion by fishermen from other harbors. Perimeter-defended areas are individually defended territories which are much smaller and have more precise boundaries than the nucleated territories. Perimeter-defended territories also define some level of group membership, but the lines are drawn around smaller groups, usually along kin lines.

Territoriality as practiced among Caye Caulker fishermen is not enforced as strictly as in Maine, but does share certain structural characteristics. Traditionally, community membership and access to lobster fishing areas have been synonymous at Caye Caulker. In this respect access to the local lobster fishery parallels the nucleated type of territoriality practiced among Maine lobstermen. Fishermen from Caye Caulker have claimed areas around the cayes, and over the years, have expanded southward among the smaller uninhabited cayes towards Belize City. Within this area, or these areas, individuals and kin based operations divide the suitable fishing areas into territories which are traditionally held by the respective person or family. These areas are similar to Maine lobstermen's perimeter-defended areas. The similarity, however, does not include defensive behavior as strict as that found in Maine.

COMMUNITY AND THEFT

Fishermen at Caye Caulker generally respect other local fishermen's territorial claims to fishing areas. Theft of lobsters from traps is, however, a common problem fishermen experience and about which all fishermen complain. Craig (1966) and Sutherland (1986), working twenty years apart, both indicated that theft was a major concern of fishermen. In 1995 fishermen were still complaining about this encroachment on their livelihoods. Most theft is not very extreme, but does occur in different degrees of severity. On any given trip out to haul traps, a fisherman will expect that a few traps will have had lobster stolen out of them before he has been able to haul them. Fishermen acknowledge and label a few local individuals as "known thieves," claiming these individuals are responsible for most theft. Currents, storms, and large marine animals move and shift traps around in the water. Because of this I suspect that less severe theft is not always intentional, resulting from fishermen accidentally pulling up traps of other fishermen who have neighboring territories. Larger scale theft occurs as well, but less frequently, and involves a more systematic and substantial theft of lobsters from traps. Larger scale theft may go on to include the theft of traps themselves. Fishermen distinguish these degrees of theft, stating that they "don't mind so much" when someone steals lobster from them, but when traps are stolen they have lost more than a few lobsters. Theft of traps is more than lost revenue, but an added input to expense in time and money, as the fisherman must buy materials for and build traps to replace the stolen ones.

At Caye Caulker thieves are tolerated, but marginalized. The extent to which thieves are tolerated depends on the thief's membership in the community and the level of theft for which they are "known" or of which they are suspected. Thieves are, however, in a position to assert some, albeit marginal and perhaps somewhat less legitimate, rights to the lobster resources around the caye. Since thieves and thieving are tolerated, access to the resource in this way is allowed. There is frequently talk of theft, accusations, and an occasional threat, but direct action is rarely taken. Fishermen say they cannot take action, formal or informal, for fear of retribution and revenge from the alleged thief.

One situation, however, differed from other allegations of theft against people diving for lobsters. This situation involved two young men from Honduras who arrived on Caye Caulker and began inquiring about fishing for lobster and getting equipment to dive at the reef. These two men associated themselves with a locally "known" thief who also dives. After they had been at the caye for a week or so, I was warned to not associate with these two men, because they were trouble, "they steal lobsters... and break the coral at the reef." Shortly thereafter the two men were gone. This situation further illustrates that there is not open access to the local lobster fishery. Theft from territorial fishermen does "open" access to the fishery, but not fully. Property rights in this fishery are communal, based on community membership at Caye Caulker.

Tolerance of local thieves functions as a leveling mechanism, or some crude approximation of a "folk welfare" system. This tolerance combined with the likelihood of "accidental" theft poses a problem common to the management and/or governing of common pool resources (CPRs), that of monitoring or self-regulation (Jentoft and Kristoffersen 1989:355; Ostrum 1990:185-88). Monitoring is one of the components necessary for localized, self-governing institutions to successfully manage CPRs over the long term (Ostrum 1990:90). The continued presence of tolerant behavior towards thieves makes the development of mutual monitoring a difficult goal in the development of any institutions, state or local, for the management needs of this fishery. The FMS at Caye Caulker has endured to the present without significant mutual monitoring among and between fishermen within the local lobster fishery. The important questions now are: Will this system continue to endure in the face of new and increasing pressures on the lobster resource and on social relations at the caye? Can it endure without some form of mutual monitoring?

Resilience or Disintegration?

The FMS at Caye Caulker has recently begun to disintegrate with the advent of many changes affecting the local socioecosystem. The more evident changes are new and larger markets for lobsters and the growth of tourism. These markets are emerging locally and abroad — the former via tourism development at the caye, the latter as a result of the cooperative's growth and diversification catering to markets in North America and Asia. Recent changes in the transfer of territories and the growth of tourism development are affecting this FMS's resilience, with possible implications for the lobster population and the cooperative's historically stable production.

Territoriality and cooperative organization coupled with the growth of tourism have, however, provided the right conditions for socioeconomic differentiation to emerge. Fishermen's choice of investment strategies, the expression of their success in community development, has in different ways shaped a new set of social relations among islanders, which are affecting the FMS's integrity and endurance. Access to capital resources and high incomes through the cooperative and territoriality have allowed fishermen to retain ownership of their increasingly valuable property on the caye and develop their community largely in ways they see fit and by their own means. This resulting success story in local community development is manifest in primarily three ways. Fishermen have invested in: 1) their children's educations at colleges and universities in Belize City and North America; 2) expanding and/or diversifying their fishing efforts; and 3) tourism development at the caye. Though each of these strategies defines some local meaning of success, they are also contributing to the deterioration of the FMS.

EDUCATION AND CHANGING TENURE PATTERNS

Education is a common index of socioeconomic status and one way parents try to ensure a better life for their children. Fishermen from Caye Caulker have used their earnings from lobster fishing to invest in their children's educations. Occasionally some families send children to live with relatives, who have emigrated to the United States, to earn a high school diploma. More frequently, fishermen send their children to Belize City or to the United States for college educations. When young boys leave the caye to pursue these educational opportunities, very few return to make a career out of fishing. This emigration of fishermen's children is creating a gap in the traditional transfer territories and access to the fishery. This gap is being filled by more frequent exchanges of traps and territories through monetary transactions.

Territories have traditionally been passed on to family members as described above, or new territories are added in far away or marginal areas. Working one's way into the fishery by working with an established fisherman still occurs, but is no longer the only way territories change hands, or that someone may gain access to the fishery. Traps, and territories in which to place them, can be purchased from older, established fishermen, whose children have left the caye. When a fisherman sells his traps the territory in which the fisherman traditionally placed the traps is usually part of the transaction.

Territories and traps are now becoming more available to people who may otherwise be locked out of the fishery and to established fishermen trying to expand their fishing efforts. This commodification of territories, or of access, is a trend towards privatization, a process which has occurred in a Mexican lobster fishery in Ascension Bay (Leslie 1995). Leslie makes a distinction between fishermen with "property rights" and "access rights," who are locally referred to as *dueños* and *chalanés*, respectively. Fishermen with property rights own access to *campos*, the fishing territories in which artificial shelters are placed. Fishermen with access rights do not own *campos*, but have access to fishing them by selling their labor to *dueños*. A similar differentiation and pattern may be developing among fishermen at Caye Caulker.

Established fishermen at Caye Caulker are more likely able to afford to buy the traps made available through the increased emigration of other established fishermen's children, and in turn are more likely to enforce their rights to fish the territories associated with them. It is in this space that the larger operations I mentioned earlier have emerged and developed. Along with the accumulation of territories and a trend towards *ownership* as distinct from *access*, there are other "opportunities" for fishermen without territories — they may sell their labor either to fishermen whose children have left the cayes, sell their labor to fishermen with too many traps that he and his close kin alone can haul, or steal from other fishermen's traps. Socioeconomic differentiation seems to be emerging from a traditional and historical situation of communal ownership, where community membership defined who had access to the lobster resources around the cayes, to one of privatized ownership of trap/territory units around the cayes. The presence of theft at Caye Caulker, however, may distinguish this case from the one described by Leslie in Mexico.

As common property theorists have argued, privatization will decrease the likelihood of resource depletion in a tragedy of the commons scenario (Hardin 1977; Scott 1955; and see Acheson 1989; McCay and Acheson 1987). However, as access to the fishery around Caye Caulker is becoming more privatized, it is instead becoming more open. The escalating theft from fishermen traps indicates this change (Sutherland 1986:30-32). In 1995 fishermen were still complaining of this problem, almost unanimously pleading, "there's nothing we can do." That there are only very few and marginal areas open for newcomers who cannot afford to buy access and increasing theft from established and new territory owners, leaves us with the following question: How will this commodification of territories affect the nature of territoriality, regulation of access, and the level production of lobsters seen up to the present?

TOURISM AND HARVESTING SMALL LOBSTERS

Since around 1980 Belize has experienced a dramatic increase in tourism. Tourism development at Caye Caulker, though growing, is still small in scale and locally controlled when compared to neighboring San Pedro on Ambergris Caye. San Pedro was a small fishing village before it was transformed by tourism development (Arnaiz Burne 1996; Sutherland 1986:132-134). Many people at Caye Caulker mention this in comparing how San Pedranos have "sold out," and that the "front (beach property) is for tourists..." not the islanders. Villagers at Caye Caulker feel that they have a much higher degree of self-determination in their community's development than do villagers at San Pedro. This is not to say that tourism has not affected the cayes, its residents, or the ecosystem on which their livelihoods depend.

Besides the cool Caribbean breeze and "Go Slow" attitude posted on the speed limit signs, many tourists come to Caye Caulker for the lobster served in the local restaurants. Practically all lobsters served in most local restaurants are undersized lobsters illegally harvested and sold at the cayes. Fishermen's disincentive towards mutual monitoring obtains not only for inaction towards theft, but also in the harvest of "shorts." Shorts are lobsters with a carapace length less than three and a quarter inches or a tail weighing less than four ounces. These are the size limits set by Belizean Fisheries Laws. Fishermen also call

these "small lobsters," "undersized," and "illegal." A resident marine biologist refers to them as "pre-reproductive."

All lobster fishermen at Caye Caulker take small lobsters. Most fishermen only take them for household consumption. Relative to the scale of restaurant consumption, this portion is negligible, usually numbering less than twenty individual lobsters per week per fishing family (extended family, as many as three or more households). Fishermen and their family members do not regard the lobsters they take for household consumption as a harmful practice; "we've always done it," they say. This portion of the catch has been at a more constant rate since the beginning of the industry than that of tourist consumption.

Fishermen and other islanders suggested that this portion of the undersized lobster catch at the cayes varies between fifty and one hundred pounds of lobster tails per restaurant per week. By these accounts I estimate that in recent years at least 63,000, but perhaps over 125,000, pre-reproductive sized lobsters are harvested annually for consumption by tourists visiting Caye Caulker.⁵ As tourism continues to increase on the cayes the lobster population will begin feeling increased pressure, and, if they have not already, fishermen will be the next to feel this pressure. Because this portion of the catch is undocumented, any impact may not be documented in certain quantifiable terms in NFCS or Belize Fisheries Department reports, at least until it may be too late. Harvesting small sized lobsters is a pressure on the lobster population, and local ecosystem, which will, I suggest, have the most significant impact if not checked and managed.

The absence of a locally appropriate monitoring system among Caye Caulker fishermen is perhaps the single most significant and difficult challenge to this task. Sutherland describes an ethic of non-interference, a "mind your own business attitude" which is manifest in "extreme tolerance of other people's actions," among villagers at Caye Caulker (1986:115). This she discusses in terms of general social interactions and gossip about "troublemakers." This non-interference permeates into the fishery as is seen in fishermen's unwillingness, or the social-structural constraints, to report or take action against thieves. Since many fishermen when hauling their own traps steal (intentionally or not) from neighboring fishermen's traps, mutual monitoring will not likely emerge without encouragement and great effort. The extreme difficulty for fishermen to engage in mutual monitoring in order to curb the harvest of undersized lobsters then becomes apparent.

Discussion

A general problem arises in research concerning and discussions of FMSs and their success, sustainability, or ability and capacity to conserve a resource — FMSs are extremely varied. Generally speaking, among fishing peoples, folk management systems are local adaptations to marine environments.⁶ Folk management systems are instigated, maintained, and practiced by local resource users, rather than implemented and enforced by state authority. Folk management systems often function within, and sometimes even against, state level management plans and regulation efforts. In many cases these local efforts successfully manage the use of and access to fisheries resources (Acheson 1981; Dyer and McGoodwin

1994). FMS variation is not a problem in the sense that the variation deems their categorization meaningless. Rather, the problem lies in not recognizing — or when recognized, not being explicit about — the functional significance and actual role these institutions play in the larger resource systems of which they are a part.⁷

FMSs are not significant so much for their supposed conservationist ends, but for their social structural characteristics within which and by which resource appropriators (fishermen in this case) are able to, allowed to, or are willing to have a voice or play some role in determining the allocation and distribution of the CPR. This is a view of resource management forwarded by Marchak, concerning the British Columbia fishing and fish-processing industries (1987). This view argues that resource management is more directly organized around and directed towards the management of the allocation and distribution of resources than with conserving resources. Resources here include both access to natural resources, such as fish, quotas for fish, or fishing space, and capital resources in the form of government programs and regulations which attempt to fill the gaps left by inequitable, or less than perfect, policies and development agendas. In this sense, the importance of research into FMSs lies in gaining understandings about how and under what conditions people organize, create institutions, and act collectively (or not) under circumstances of exploiting CPRs, in order to conserve resources *for themselves*. Conservation is not the initial motivating factor in folk management systems; control over and self determination in the allocation and distribution of CPRs are. When considered with an eye to the long term with commitments and monitoring institutions agreed upon by localized communities of resource appropriators, we will likely see results known as or described as conservation.

According to many models of human behavior and human nature in situations of CPR exploitation, people are assumed to, and even expected to, have no agency or interest in independently facing and dealing with the problems which arise under CPR contexts (Hardin 1977). Solutions to common dilemmas are thus delegated to state authority and power or to the responsibility supposedly inherent in the institution of private property; resource appropriators become the sheep of Hardin's hypothetical pasture. Hardin does acknowledge that there are problems to be faced in the exploitation of CPRs, but his model is not sufficient to explain or help to more fully understand the variation of human adaptations and potentials for human creativity. To address the shortcomings of Hardin's model we are forced to understand the situations which do not fall under its predictions. Why are some people, or groups of people, able to organize and create institutions which cope with the conflicts and other problems of CPR exploitation, while others succumb to "the tragedy of the commons?"

Critics suggest that FMSs are often forwarded as sustainable solutions to CPR management problems, and may be superior to "scientific" and centralized management regimes, but do not rely on sufficient data to show conservation (Acheson and Wilson 1996:586; Durrenberger 1997; Johnson 1997). This is not to say that such systems do not conserve or otherwise manage resources. FMSs are not solutions in themselves to CPR problems, especially within state and market systems (Palmer 1994; Pinkerton 1994). Rather, if recognized for what they are — decentralized (or less centralized), usually more democratic,

locally appropriate, and often without direct ties to state bureaucracies — FMSs are a vital aspect of the social and cultural constitution of complex resource systems. In this light FMSs are critical aspects of fisheries, knowledge and understandings of which are necessary for more effective management.

Conclusion

Among fishing peoples, folk management systems are cultural adaptations which merit further examination by those concerned with resource management. The point of researching folk management systems lies in acknowledging that local institutions, organizations, and knowledge are important aspects of resource systems. Additionally, and more pointedly, there is a need to encourage policy makers and enforcers to understand, respect, and tap these social resources in attempts to work *with*, rather than against or in spite of, the fishermen participating in these fisheries resource systems. Documenting and acknowledging the beneficial results of folk management systems does not suggest that government involvement in resource management should stop. These folk systems are not perfect, and often are unable to cope with new and increasing pressures on the resource brought about by technological innovations, intensified effort, and larger product demand, as is the case in the lobster fishery around Caye Caulker.

Lobster fishermen at Caye Caulker have developed local institutions to cope with the problems of access to and distribution of local common pool resources. These institutions constitute a folk management system which have contributed to stable production of lobsters to the present. Changes in the socioecosystem at Caye Caulker are threatening the integrity and resilience of this folk management system. Preserving Caye Caulker fishermen's territoriality and other aspects of their cooperative organization is not the answer to their long term prosperity; nevertheless their long term prosperity is contingent upon understanding and utilizing the institutions embedded in and constituting this system.

Anthropologists have recognized the significance of local institutions and local knowledge among fishing peoples. In attempts to develop more appropriate and legitimate solutions to CPR management problems some anthropologists have argued for various forms of cooperative management (co-management) involving local resource users, other industry interests, and state or federal governmental agencies (Jentoft 1989; Pinkerton 1989, 1994), and parametric management (Acheson and Wilson 1996). Co-management emphasizes "appropriate local involvement" (Pinkerton 1987:323), which is best determined through an ethnographic understanding of the social-economic-political relations and local institutions which are often embedded in and constituent of FMS. With such an understanding appropriate assessments and policies may be formulated through involving localities in the management process in relevant ways which are locally legitimate (Jentoft 1989:154). Parametric management places emphasis on understanding and preserving the biological life processes and ecological relationships of target species sought after in a fishery (Acheson and Wilson 1996). Factors such as water temperature, feeding habits, migratory paths, etc. are important in knowing

the state and health of a resource (a fish population) and from this knowledge the human impact on this current state can then be measured, and hopefully managed. Acheson and Wilson contend that fishermen are the ones who have access to this knowledge, either directly through their fishing practices or potentially as in most cases fishermen are the most intimately related to the resource and could learn to know how to collect information which would be insightful for management (1996:588-589). In this way locally relevant and meaningful strategies and practices can best be implemented, which are smaller in scale and focus management on the local level, as Acheson and Wilson, among others, suggest.

Caye Caulker fishermen do not consider their territorial system as an effort at conservation, but merely a part of how they fish. They are, however, aware of the potential good of a conservation ethic and the importance of conserving the local lobster population. From their point of view, conservation is something biologists do and Fisheries Department Officers enforce. For most fishermen on Caye Caulker, "conservation" is the realm and responsibility of authority. Interviews also reveal, however, that fishermen realize how their fishing practices are intimately tied to the goals of conservation. Though they do not see themselves practicing "conservation," they do see themselves in a position "to conserve" the lobster in how they choose to fish. Despite that cooperative organization and territoriality have contributed to stable production of lobster tails and that a portion of this harvest has been reserved for Caye Caulker lobster fishermen, conservation is not, and has not, been the motivation for the emergence of these institutions. Similarly in Maine, lobstermen and industry interests enacted conservationist measures into law through lobbying the state legislature, but not until many years later did a conservationist ethic emerge among fishermen in this industry (Acheson 1997).

The changing social and natural environments at Caye Caulker make it imperative that efforts are made to ensure the long term sustainability of the lobster fishery. This includes not only the health of lobster habitat and the health of the lobsters' reproductive population, but additionally a careful understanding of the social fabric which shapes the productive capacities and management needs of this fishery. How fishermen at Caye Caulker, and in Belize more broadly, exploit the lobster population affects the entire reef-seagrass bed-caye ecosystem. This ecosystem is the basis for many Belizeans' livelihoods in the fishing industry and other sectors as well. Many fishermen harvest small-sized, pre-reproductive lobsters which are served in local restaurants. In the next few years the impact of this illegal and harmful practice will certainly appear if it continues at the present scale and rate. In this respect fishermen's experience and perception of slimmer catches in recent years are telling. Caye Caulker fishermen have shown that nearly sustainable production levels can be achieved. But for their efforts to prove resilient, further adaptations are necessary, such as mutual monitoring, as the rest of the world grows closer to them and they extend beyond their local setting through their cooperative's success.

NOTES

¹The two primary groups migrating to Caye Caulker are Creoles and Garifuna. Both are African descended, "mixed" populations.

Creoles are commonly associated geographically with Belize City and are of African and European (and most likely other ethnic groups) descent. Garifuna arrived in Belize from settlements along the Caribbean coast into Honduras. Their ancestry is a mixture of African slaves and Carib Indians. They were exiled from St. Vincent by the British in the 1700s. Ethnicity is a significant defining characteristic of community membership at Caye Caulker. The short duration of my research at Caye Caulker did not permit me to explore in depth the ethnic relations explicitly, a feature of social relations which deserves fuller attention.

²I will be using fishermen throughout this paper to refer to lobster fishermen. These fishermen do fish for other species besides spiny lobsters, however, the spiny lobster is the source of nearly all their income (Palacio 1996:37).

³For detailed histories of the lobster industry in Belize see Craig 1966; Gordon 1981; Palacio 1996:31-38; Sutherland 1986; A. Vega 1995 (1973); and S. Vega 1979.

⁴Oil drums are also used as traps. Some fishermen prefer this larger, bulkier trap to the wooden ones, and suggest they catch more lobsters. All fishermen use the wooden traps, however.

⁵I only considered seven restaurants in this estimation. There are more than seven restaurants on Caye Caulker, but some cater more to local people, or are open only through lunch. One tourist restaurant I did not include is the Sand Box, which has a reputation on the cay as "the only restaurant that serves legal lobsters." This estimate is for Caye Caulker tourist consumption only. Caye Caulker is considered a smaller scale, "backpacker" type tourist destination. I can easily speculate that other tourist destinations, especially San Pedro, have a much higher rate.

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